SCIENCE

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AIMS, METHODS, AND RESULTS IN MEDICAL EDUCATION[1]

MEDICAL education represents an organized attempt to train men to apply scientific methods to the prevention, cure or alleviation of disease and to the advance of medical knowledge. To this end the public, the teachers and the students all contribute. The public through endowment or state support now pays the more liberally supported schools at least $300 per year per student, or $1,200 for the four-year course; the teachers by rendering skilled service for less than what they might earn in practise probably contribute at least as much, while the time of the student in addition to his tuition fees and other expenses makes his contribution worth not less than $1,000 per year or $4,000 for the course, in addition to which he usually devotes several thousand dollars' worth of time to postgraduate study.

The public gets the largest returns from the investment both from the advances in medical knowledge which come from the better supported schools and from the increased efficiency of medical service which benefits not only those individuals who pay for services received but also the community at large. The students, who furnish by far the largest part of the investment, may ultimately get some fair financial return from this investment but must look to joy of service for the chief return. The teachers find their main reward in the companionship with youth in devotion to ideals.

[1] Presidential address at the annual meeting of the Association of American Medical Colleges, Chicago, February 8, 1916.

The results of the joint product of educational plants, teachers and students, are to be determined, on the one hand by the scientific output of the institution and on the other hand by the ability of the graduates to perform the services for which they are trained. This ability does not become fully manifest until the youths of to-day become the mature men of to-morrow. We do not manufacture a product ready to work perfectly the minute it is turned out and for which there is an eager market to stimulate us to devise methods of turning out an ever greater quantity at less cost. On the contrary we have to devise methods which will train men to fill in a worthy way the medical needs of the nation a generation in the future, men for whom when first turned out the public does not seem particularly eager.

Our methods should be designed to furnish the requisite training as directly, simply and inexpensively as possible, compatible with adequate results. In studying and trying out methods we should, however, focus our attention on the end results desired, not on artificial standards such as have at times been introduced by efficiency engineers and other professional students of other peoples' business who have been active of late in the field of education and who are apt, because of the difficulty of determining the nature of the products of an educational institution, to adopt some such standard as the unit hour of instruction as the product or to base estimates of efficiency on the elaboration of machinery. On the whole, however, I believe that we have been fortunate in the breadth of view shown by outside investigators of our own field of education and that we ourselves are to be blamed for too much emphasis on time requirements, too great a readiness to standardize without sufficient study of the ultimate result produced. This attitude has led to a condition where the requirement of two years of premedical college work has made much more rapid progress in the requirements of licensure to practise in various states than have practical examinations in medicine.

Under the cheaper methods of medical instruction which prevailed in this country until recent years the results on the whole were not satisfactory. It has been stated that as many as forty per cent. of medical graduates quit the practise of medicine within a few years after leaving the medical school. Of the rest some by natural ability and hard study subsequent to graduation became of great value to society and others, allowing themselves to drift, became venders of prescriptions but not men able to apply modern science to relieve disease.

The recent developments in medical education have added greatly to the expense of maintaining medical schools and to the cost in time and money to those seeking a medical education. Are the results satisfactory? Can they be improved? Can the expense be reduced without injuring the product? These questions can not be answered satisfactorily at the present time, first, because of the relatively short period that the newer methods of medical education have been in force and, second, because of the absence of satisfactory records of the subsequent careers of our graduates. They are, however, questions which every institution should carefully study and from time to time various institutions should report the results of such studies because of the help to other institutions thus furnished. Only one institution, at present, the Johns Hopkins Medical School, I believe, furnishes an account of the subsequent careers of each of its graduates. Since this institution was the first

to assume what have since become, with a few modifications, the modern standards of medical education in this country[2] a statistical study of the careers of the graduates of the first ten years, 1897–1906 inclusive, may be of value in throwing light on the results produced by recent trends in medical education. To me the study has been of special interest because I was a member of the first class and assisted in teaching the other classes.

TABLE I

Careers of Graduates

(J. H. U., 1897–1906)

	Total Number	Women	First 5 Classes	Second 5 Classes
	456	55	166	290
Died	5.7%	7.3%	8.4%	4.1%
Withdrawn	3.3	18.2	6	1.8
Practise	80	70.9	71.1	85.2
Science	8.8	1.8	13.3	6.2
Administration	2.2	1.8	1.2	2.8

[2] The requirement of premedical college work covering physics, chemistry, biology and a modern language, adopted to the extent of one year by the Association of American Medical Colleges and to the extent of two or more years by a large proportion of the schools in the association is a modification of the requirements adopted by the Johns Hopkins Medical School beginning with the first class which entered in 1893. For matriculation a student was required to have a college degree and to have had college training in physics, chemistry and biology, a reading knowledge of French and German and as much Latin as may be studied in two years in a high school. With the exception of the last, the only high-school subject specifically required, and some of the modern language which could be studied in the high school, the specific requirements of the Johns Hopkins could be covered by two years of college work. The standards now adopted by most of the better schools are quite similar except that but one modern language is required instead of two. Furthermore, the Johns Hopkins curriculum devoted the first two years to work in the basal medical sciences, the last two to clinical work, an arrangement in the main now generally adopted. The standard of full-time teachers and investigators in the basal sciences then established has likewise been widely accepted.

TABLE II

Fields of Practise

(J. H. U. Graduates, 1897–1906)

	Total in Practise	Women in Practise	First 5 Classes	Second 5 Classes
	365	39	118	247
General practise without specialization	22.2%	35.8%	16.9%	24.7%
General practise with specialization	20.5	46.1	18.7	21.5
Internists	9.6		18.7	5.3
Medical specialties	11.2	7.7	5.1	14.2
General surgery	15.9		17.8	15
Surgical specialties	9.9		10.2	9.7
Eye, ear, nose and throat	5.2		6.8	4.1
Obstetrics	5.5	10.2	5.9	5.3

TABLE III

Subdivisions of Activities

(J. H. U. Graduates, 1897–1906)

General Practise

Number of Individuals, 156

	Per Cent.
No specialty indicated	51.9
General practise combined with	
Public health work	9
Laboratory work	7.8
Pediatrics	5.8
Obstetrics	1.9
Surgery	10.9
U. S. army surgeons	3.8
Institutional work	3.8
Medical missionaries	5.1

Teachers, 7.7 per cent.

Medicine

Number of Individuals, 76

	Per Cent.
Internists	46
Pediatrists	14.5
Neurologists	10.5
Dermatologists	8
Laboratory diagnosis	21.0

Teachers, 63.2 per cent.

Surgery

Number of Individuals, 133

	Per Cent.
General surgery	43.6
Gynecology	10.5
Orthopedics	7.5
Genito-urinary surgery	9
Eye, ear, nose and throat	14.3
Obstetrics	15

Teachers, 42.1 per cent.

Science

Number of Individuals, 40

	Per Cent.
Anatomy	15
Bacteriology	2.5
Physiology	15
Hygiene	5
Roentgenology	2.5
Pharmacology	7.5
Medicine	12.5
Pathology	40

Teachers, 90 per cent.

Administration

Number of Individuals, 10

	Per Cent.
Hospital	50
Public health	40
Medical association	10

Teachers, 0

Four hundred and fifty-six students were graduated in the ten classes under consideration, 166 in the first five classes, 290 in the second five classes. Fifty-five were women.

Table I. shows the general careers of these graduates. Twenty-six, 5.7 per cent., have died, fifteen, 3.3 per cent., have retired from practise. Of the latter, nine are women who retired because of marriage. Only five men, 1.3 per cent. of the total number, have withdrawn from medical work. These figures are certainly in marked contrast to the forty per cent. of graduates supposed to have dropped out of practise under the old system of medical education.

Of the graduates now engaged in medicine 80 per cent. are in practise, 8.8 per cent. are engaged in teaching or scientific work and 2.2 per cent. in medical administrative work.

Tables II. and III. illustrate the specialization within the fields of practise and scientific work that has taken place. The percentage of graduates within each of these fields is shown. The data tabulated are based on the records published in the Johns Hopkins Circular and in the American Medical Directory. It is probable that the specialization is carried even further than here shown.

Specialization carries with it in most cases, and should in all cases, special training beyond that offered in the medical school. Table IV. shows the number of graduates in each of the main subgroups and the percentage of graduates in each of these groups whose records show special training subsequent to graduation. These records, as published in the Johns Hopkins Circular, are necessarily incomplete and undoubtedly represent far less than the total amount of postgraduate work and study. In the third column the percentage is shown of the graduates of each group who took a hospital interneship of one or more years, in the fourth column the percentage of those taking an interneship of two or more years, in the fifth column the percentage of those who took laboratory work but not a clinical interneship, in the sixth column the percentage of those whose postgraduate work was confined to graduate study, in the seventh column the percentage of those whose records indicate no formal work subsequent to graduation, and in the eighth column the percentage of those who took an interneship at the Johns Hopkins Hospital. Since these last interneships are open to students in the order of their class standings, the percentage of those in a group accepting them indicates the general scholarship of the group, although some of the best students in each class take work elsewhere.

From this table it may be seen that the 81 graduates now in general practise whose records shows no specialization belonged to the group with a relatively low grade of scholarship as undergraduates and with

TABLE IV

Special Training after Graduation

(J. H. U. Graduates, 1897–1906)

1	2	3	4	5	6	7	8
Group	Number in Group	Hospital Internship at Least One Year	Further Residence Training	Laboratory Work Only	Graduate Work Only	Special Training not Specified	J.H.H. Internes
		% of Group	% of Group	% of Group	% of Group	% of Group	% of Group
General practise without specialization	81	63	34.6	3.7	1.2	32.1	16
General practise with specialization	75	80	56	6.7	1.3	12	17.4
Total general practise	156	71.2	44.9	5.1	1.3	22.4	16.9
Internists	35	77.1	62.9	14.5	2.9	5.8	42.9
Pediatrists	11	72.7	63.6	18.2	9.1		18.2
Neurologists	8	75	75	12.5		12.5	0 (37.5% Disp.)
Dermatologists	6	33.3	16.7		66.7		0 (66.7% Disp.)
Laboratory diagnosis	16	25	6.3	75			0
Total medicine	76	61.9	48.77	25	9.2	3.9	22.4
General surgery	58	87.9	74.1	7	1.7	3.4	46.6
Gynecology	14	85.7	57.1	7.1		7.1	71.4
Orthopedics	10	100	60				50
Genito-urinary	12	75	58.3		8.3	16.6	33.3
Eye, ear, nose, etc.	19	58	21	5.3	26.3	10.5	10.5
Obstetrics	20	90	80			10	55
Total surgery	133	83.5	63.2	4.5	5.3	6.8	44.4
Science teachers	40	50	15	50			42.5
Hospital superintendents	5	100	100				0
Public health officers	4	75	25	25			0
Others	1			100			0
Total	415	71.6	48.9	13	4	11.3	29

the least training after graduation, 32.1 per cent. giving no record of such training.

The 75 graduates in general practise who are specializing to a greater or less extent, on the other hand, show but 12 per cent. without interneship or some other form of postgraduate training.

The 76 graduates in the group of specialists in internal medicine show but 3.9 per cent. without special postgraduate training, although in this group laboratory work, chiefly in pathology, has been to a considerable extent substituted for clinical interneships. The two men of the group who now hold the chairs of medicine at Harvard and Columbia, respectively, had a postgraduate training largely in pathology. The internists show a high percentage of Johns Hopkins Hospital interneships while the neurologists and dermatologists have depended more on dispensary training, a third of the first group and two thirds of the second having had work at the Johns Hopkins Hospital Dispensary.

The 133 graduates who have specialized in general surgery and its various branches show a high record of undergraduate scholarship as evinced by the high percentage of Johns Hopkins Hospital interneship, and few, only 6.8 per cent., without records of special postgraduate work, chiefly interneships. The length of time spent by many of these surgeons as internes and residents in hospitals is considerable.

Thus the total resident hospital service spent by the 22 general surgeons who received one or more years of their hospital training at the Johns Hopkins was 98 years, an average of 4½ years. That of 8 gynecologists with similar training was 37 years, likewise an average of about 4½ years, while that of 11 obstetricians was 39 years, an average of about 3½ years. The length of service of different individuals varied in surgery from 2 to 8 years, in gynecology from 3 to 7 years and in obstetrics from 2 to 5 years.

With this long hospital service of graduates preparing for surgery may be compared the services of a similar group of 13 men preparing for internal medicine. These men served a total of 50 years, an average of nearly four years, with variations in length of service from 2 to 10 years.

Of the graduates in the surgical group those whose records show the smallest percentage of specialized graduate training belong to the genito-urinary surgeons and the eye, ear, nose and throat specialists. These men undoubtedly have for the most part had a large amount of dispensary training not indicated in the records.

The 40 graduates included in the science group all had, as assistants and young instructors, a large amount of special laboratory training subsequent to graduation. Yet 50 per cent. of them first spent a year or more as clinical internes.

The 10 men now engaged in administrative work all had some special postgraduate training, in most cases including a hospital interneship.

The long course of preparation, four years in college, four years in the medical school and several years of subsequent training for a specialty which marks the career of so large a percentage of those under consideration would lead us to expect to find most of them settled in large centers of population where specialists have the best opportunity to exercise their calling and get return from the heavy investment in time and money. This is the case. The graduates of the first ten classes are widely scattered over the country from Maine to California and from Minnesota to Louisiana but for the most part they are settled in large cities, Baltimore naturally claiming the lion's share, but with a relatively large number in New York, Boston, St. Louis and San Francisco.

TABLE V

Location According to Size of Towns

J. H. U. Graduates, 1897–1906, Practitioners Only

Population of Residence	Total No.	Women	First 5 Classes	Second 5 Classes
	329	33	108	221
1,000,000+	9.4%	15.2%	10.2%	9 %
400,000+	30.7	15.2	29.6	31.2
200,000+	16.7	18.2	19.4	15.4
100,000+	11.5	9.1	16.7	9.1
50,000+	10.9	9.1	7.4	12.7
20,000+	6.4	15.2	6.5	6.3
10,000+		6.1	2.8	4.5
5,000+	6.7	3	2.8	2.77
5,000−	6.4	6.1	1.9	8.6
Foreign	1	3	2.8	0.5

Table V. shows the distribution of the graduates engaged in private practise in this country and its dependencies, marked "foreign" in the table, according to the size of the communities in which they are located. From this it may be seen that over two thirds are located in cities of 100,000 inhabitants or over, and relatively few are located in towns of 10,000 inhabitants or less.

The great majority, therefore, are in active competition with first-class men in large centers. How many have made a striking success? This is a difficult matter about which to form a fair judgment. Excellent service may lead to a merely local

reputation while the ability of a mediocre man to get articles into popular weeklies or into the newspaper may lead to inclusion in "Who's Who." In order, however, to get some measure of success I have tabulated (Table VI.) the percentage of those

TABLE VI

Societies and Distinctions

(J. H. U. Graduates, 1897–1906)

Group	Number in Group	Fellows A. M. A., %	Members Spec. Soc., %	Fellows A. C. S., %	Who's Who, %	American Men of Science, %	Starred Individuals, %
General practise without specialization	81	54.3	6.2	0	2.5	2.5	
General practise with specialization	75	72	5.3	0	1.3	4	
Internists	35	91.5	48.6	0	28.6	22.9	2.9
Medical specialties	41	80.5	43.9	0	2.4	14.6	
Total medical	76	85.5	46	0	14.5	18.4	1.3
General surgery	58	88	27.6	60.4	5.2	5.2	1.7
Surgical specialties	36	83.4	47.3	50	8.3	2.8	
Eye, ear, nose, throat	19	89.5	31.6	42.1	5.3	10.5	
Obstetrics	20	80	15	35	5		
Total surgical	133	85.7	31.6	51.9	6	4.5	0.8
Science	40	57.5	82.5		52.5	75	30
Administration	10	50					
Total	415	73.5	28.8	16.6	10.4	13.3	3.4

belonging to various special groups who have been made members of special scientific medical societies, of those who have been included in "Who's Who," and in "American Men of Science," with a special column for those starred as among the first 1,000 men of science. Since the last edition of "American Men of Science" was published in 1910 the scientific standing of the members of the later classes to graduate is not up-to-date. For the sake of comparison I have also shown the percentage of each group who are fellows of the American Medical Association and I have included a special column to show the Fellows of the American College of Surgeons.

The graduates who have taken up a career in science show the greatest percentage of those included in "Who's Who" (52.5 per cent.) as well as in "American Men of Science" (75 per cent.) and in the starred list (30 per cent.). The internists come next (28.6 per cent. in "Who's Who") while relatively few of the surgeons are thus distinguished (6 per cent.). The surgeons represent, on the whole, the strong students with a practical rather than a scientific attitude of mind, while the internists represent a group of strong men with both "practical" and scientific leaning. Taking the whole group of 415 individuals now engaged in medicine we find 10.4 per cent. included in "Who's Who," 13.3 per cent. among "American Men of Science" and 3.4 per cent. among the starred individuals.

For the sake of comparison the following rough estimate[3] may be of interest:

[3] These estimates, necessarily rough, are based on the following data. The population of the country is taken as 100,000,000. The number of males of a given age is based on the ratios given in the last United States census reports. The number of college graduates is based on the ratio between academic and medical students during the last quarter of the nineteenth century and on the assumption that the ratio between the number of living individuals with the M.D. and of those with the bachelor's degree corresponds with this ratio but with somewhat fewer students finishing the academic than the medical course. This gives as a rough estimate 500,000 college graduates, a number probably too high if graduates of regular college courses of the old type are alone counted, too low if the graduates of all sorts of technical courses leading to the bachelor's degree are counted. It is arbitrarily assumed that of the 500,000 graduates, 350,000 are men and the ratios used in estimating the general male population of a given age are used in determining the number of college graduates of a given age, the age of twenty-two being taken as the minimum

TABLE VII.

Adult Males	Est. Number	Per Cent. in Who's Who	Per Cent. in American Men of Science	Starred List
30–39 years of age...	7,700,000	0.029	.015	.003
40–49 years of age...	5,600,000	0.77	.04	.008
Male college graduates:				
30–39 years of age..	91,000	1.18	1.1	.24
40–49 years of age..	65,800	3.2	2.8	.6
Physicians, men:				
30–39 years of age..	44,000	.41	0.8	.15
40–49 years of age..	32,000	1.1	0.8	.15
Second five classes:				
Living men.....	254	3.9	9.1	1.2
First five classes:				
Living men.....	125	25.6	25.6	8.8
Both classes	379	11.1	14.5	3.7

age of those graduates. The number of physicians is estimated from the numbers given in the last edition of the American Medical Directory, an arbitrary allowance of 2½ per cent. being made for women physicians. The number of physicians of a given age is estimated like that of college students but twenty-five is taken for the minimum age. The estimates of the Johns Hopkins graduates are based on actual figures. The numbers of those given in "Who's Who" are taken from the last edition but the age ratio and sex ratios are taken from data given in the 1903–05 edition. The estimates of those included in "American Men of Science" are based on the figures 5,536 for all individuals and 1,201 for starred individuals (269 names being added to the list of 1,000 in the first edition and 68 removed). The age ratios for the thousand leading men given by Cattell in the last edition are used for estimating the number of individuals of a given age in both lists. Since the age of the leading men tends to be higher than that of those not attaining distinction, this method of estimating probably gives figures smaller than the actual figures for those merely included in the total list and possibly also for those who make up the 200 starred individuals in excess of the 1,000 on which Cattell bases his estimates. Since, however, no allowance has been made for the two or three per cent. of women in the lists and for Canadians in the first list, it is probable that the estimates used give sufficiently accurate results for our present purposes. Cattell in his statistical tables shows at what institutions 515 of the first thousand men of science received their bachelor's degree but he does not give figures showing the number not receiving a bachelor's degree. Pearse in his analysis of the medical group (SCIENCE, XLII., p. 277, 1915) shows that about 22 per cent. of those contributing to the medical sciences took no bachelor's degree, although many of these did some college work. Since this group compared with other groups contains a high percentage of investigators who took no bachelor's degree we may take 15 per cent. as an arbitrary proportion in estimating the number of such men and this has been done in estimating the percentage of college graduates included in "American Men of Science" and among the starred individuals. Test counts supported those estimates. The age ratios are estimated as given above. Scott Nearing has recently made a study of 2,000 men in "Who's Who" of about the age of those here studied. *Scientific Monthly*, January, 1916.

Since relatively few women are included in "Who's Who" and in "American Men of Science" and only one of the fifty-one living women graduates in our list, we can get the best idea of the relative distinction indicated by inclusion in these two lists by comparing the percentage of men graduates included in these lists with the percentage of other men of similar age thus included. The average age of the men of the first five classes may be taken for "Who's Who" to be from about 40 to 45 years of age and of those included in "American Men of Science" from about 35 to 40 years of age. The average age of those of the second five classes may be taken to be about five years less. Without going here into detail we may say the percentage of graduates of the second five classes included in these lists is about ten times as great as would be expected from them as physicians and from nearly four to eight times as great as would be expected from them as college graduates. The percentage of those of the first five classes included in the lists is from twenty-three to nearly sixty times as great as would be expected from them as physicians and from eight to fifteen times as great as

TABLE VIII

Relation of Preliminary Training to Careers (J. H. U. Graduates, 1897–1906)

	Total No	Special Groups			Honors			
		Medicine, Per Cent.	Surgery, Per Cent.	Science, Per Cent.	W. W., Per Cent.	Science, Per Cent.	Science Starred, Per Cent.	A. C. S., Per Cent.
New England colleges for men:								
Yale	50	22	36	10	14	18	2	26
Bowdoin	11	9	27.3	9	0	0	0	0
Harvard	11	18.2	18.2	27.3	27.3	27.3	9	9
Amherst	9	11.1	66.6	0	11.1	11.1	0	44.4
Williams	7	14.3	47.2	0	14.3	0	0	42.9
5 others	11	9	54.5	0	0	0	0	9
Total	99	17.1	39.4	9.1	12.1	13.1	2	21.2
Eastern colleges for women:								
Smith	8	0	25	12.5	12.5	12.5	12.5	0
Wellesley	8	12.5	0	0	0	0	0	0
4 others	8	37.5	0	0	0	0	0	0
Total	24	16.5	12.4	4.1	4.1	4.1	4.1	0
North Atlantic:								
Johns Hopkins	67	27	29.9	13.4	14.9	19.4	3	17.9
Princeton	17	5.9	59	0	0	5.9	0	47
Cornell	8	12.5	62.5	0	0	0	0	0
20 others	39	10.3	30.8	2.6	0	2.6	0	20.5
Total	131	18.3	35.9	7.6	7.6	11.5	1.5	21.4
Middle West:								
Wisconsin	22	36.4	22.8	13.6	9.1	18.2	4.6	9.1
Knox	6	16.7	33.3	0	16.7	33.3	0	16.7
Michigan	5	0	20	80	60	60	40	0
Chicago	5	20	20	20	40	60	20	20
Adelbert	3	0	33.3	33.3	33.3	33.3	33.3	33.3
26 others	30	9.9	33.3	9.9	0	6.7	0	16
Total	71	18.3	28.2	16.9	12.7	21.2	7.1	14.1
Far West:								
Stanford	17	5.9	35.4	0	0	5.9	0	0
California	1	18.2	27.3	18.2	18.2	27.3	9	18.2
Total	28	10.7	32.1	7.1	7.1	14.3	3.6	7.1
South:								
Randolph Macon	10	10	40	10	30	10	10	20
N. Carolina	8	25	0	12.5	0	12.5	0	0
Georgia	5	40	40	0	20	0	0	0
Kentucky	5	40	20	20	40	20	20	0
Hamp. Sidney	4	25	25	0	25	0	0	25
19 others	28	25	25	7.7	3.6	10.7	0	14.3
Total	60	25	25	8.3	13.3	10	3.3	11.7
Canada	2	0	0	50	50	50	50	0
Totals	415	16.3	32	9.6	10.4	13.3	3.4	16.6

would be expected from them as college graduates. I have no data with which to compare them with other college men who have taken the medical course elsewhere. It is obvious, however, that an unusual percentage of the men under consideration have attained the kind of distinction which gives one a place in "Who's Who" and in "American Men of Science" and may be looked upon as among the leaders in their chosen fields. Of the graduates of the first two classes about one in three is in-

cluded in "Who's Who," four out of the fifteen in the first graduating class are in the starred list in "American Men of Science."

The relation of ultimate success to premedical college training is of some interest. While I have not time to go into this subject at present in any detail, I may point out in Table VIII. that students coming from the colleges of the Middle West have been particularly strong in science while those from the colleges of the North Atlantic States have been strong in practical surgery but have not gone much into research or other fields leading to a more or less national distinction. It is only by putting the graduates of the collegiate department of the Johns Hopkins in the North Atlantic division that this division is enabled to make a fair showing outside of surgery as compared with the other divisions. Based on its clientele this department might perhaps more justly be placed in the Southern division. Some points brought out by the table are difficult to explain. Why, for instance, should the graduates of the University of California make an unusually good showing from the point of view under discussion and those of Leland Stanford an unusually poor one? Why should the smaller colleges of the South do so much better on the whole than those of the small colleges of the rest of the country?

From the records of the graduates of these first ten classes of the Johns Hopkins Medical School it is clear that their success along orthodox lines has been unusually high. Into this success numerous factors have entered which we need not discuss here but not all of which can we hope to have generally repeated with the elevation of entrance standards and reorganization of methods in the medical schools throughout the country. It is evident, however, that this general reorganization is accompanied by greater scientific productivity in medicine and a greater tendency to specialization than we have hitherto had in this country, accompanied by an increased tendency to settle in large cities. What lessons can we learn from this group of graduates who represent in a way the first product of our present methods of medical education and what deductions can we make as to the directions in which we should guide medical education so as to provide adequately for a generation ahead.

The aim in requiring premedical college training in physics, chemistry and biology and in greatly strengthening the laboratory work in the basal medical sciences has been to qualify men to bring the whole force of modern science to bear on the solution of medical problems. As a matter of fact the main point of view presented to and accepted by the majority of the group of students under consideration when they came to clinical problems was what we may designate as a "looking backward" point of view. The basis on which to found conceptions of a given disease was that of its ultimate ravages in a body incompetent to resist. The course of the disease was to a considerable extent reasoned out from the findings in the autopsy room. Most of the cases seen in the hospital wards were patients in whom disease was far advanced so that the autopsy picture of similar cases was an aid in formulating a picture of the probable appearance of the organs. Even in the dispensaries a large proportion of the patients were advanced cases. Little or no opportunity was given to study the beginnings of disease and the conditions in the individual or the community which produce these beginnings, although, of course, opportunity was given to study specific microorganisms and lectures were given on etiology. Few of the group of graduates

under consideration have gone effectively into the fields of hygiene and preventive medicine, although two have achieved distinction along these lines and one has a world-wide reputation for his work in the Far East and the Near East.

The medicine of the future is certainly to become more and more concerned with the prevention of disease or with the prevention of the spread of disease not only in the community but in the individual and relatively less concerned with its ultimate ravages. Means must be devised for bringing the student in contact with disease in its incipiency both in the community and in the individual and to give a "looking forward" rather than a "looking backward" point of view, opportunity to think of disease in terms of its earliest beginnings and gradual spread, rather than merely to deduce its course from its ravages. The detection of the earliest symptoms requires far more highly trained powers of clinical observation and far more highly skilled laboratory work than does the detection of disease in its later stages. We now expect tuberculosis to be detected before large cavities have appeared or even before the specific bacilli are found in the sputum but how many physicians can do so? The field that lies between chemistry, bacteriology and clinical medicine has been greatly developed since the men we have been considering above received their undergraduate clinical training and offers great help. Modern roentgenology is also of help in early diagnosis. But the undergraduates of to-day will not get opportunity to have practical experience in cultivating these fields if abundant opportunity is not given them for coming into contact with patients in the earliest stages of disease. For this consultation and diagnostic centers, such as have been urged by insurance companies, will have to be extensively established and placed at the disposal of our clinical teachers. To encourage this the public will need some education but there is a greater demand for such centers, I think, than is understood by the medical profession. The need of preventive dentistry has long been understood by the more intelligent classes in this country. Recent developments have shown that in the endeavor to save teeth some dentists have succeeded to the detriment of the general health of the patient and have served to emphasize the fact that specialists must cooperate for the ultimate best results to the patient.

Diagnostic centers used for medical teaching will probably have to be supported by public taxation or by endowments. Similar centers should be open to those who can afford to pay a moderate fee for the services of a group of specialists. Few can afford, or feel they can afford, to go to a series of specialists and pay the fees necessary to keep up a series of special establishments unless disease is so far advanced that the necessity seems imperative. With the development of opportunities to study disease in its incipiency optimistic therapy will more and more take the place of the therapeutic nihilism that haunts the autopsy room.

The development in Europe of social insurance and its beginnings in this country will make the importance of preventive medicine increasingly clear both to the organizers of industry and to industrial workers. Somewhere in the training of our students we must make them acquainted with modern industrial problems so that as physicians they may take a wise leadership in at least the medical aspects of the industrial reorganization which is taking place.

One mistake frequently made should, I think, be pointed out. No sharp line can be drawn between preventive medicine, on the one hand, and curative medicine, on

the other hand. Public health officers can not do thoroughly effective work if they can not apply remedies to diseased individuals as well as to other sources of danger to the public health. By far the most effective public health service in this country to-day is the United States Public Health Service and here treatment of individuals and treatment of environment are carried on hand in hand. The practising physician can not do effective work for his patients if he does not take an active part in promoting public health measures.

From the social standpoint two things in the practise of medicine especially need changing. First we need more organization and cooperation of men in different lines of work in place of the extreme individualism which prevails to-day and is economically so wasteful. Hospitals should be looked to more and more as natural centers where the specialized activities of groups of physicians may be brought into harmonious cooperation and where diagnostic centers for those who can afford to pay, as well as for the poor, may be established and economically run. Hospitals of this kind established in rural districts would do much to make the conditions of rural practise more attractive and to overcome the lack of physicians which in some communities is already serious and will become more so with the decrease in the number of physicians brought about by raising of standards of medical education. A greatly reduced number of physicians in this country can serve the needs of the people effectively only through cooperation. With cooperation it will be possible to serve the community far more effectively than before. It has been estimated for instance that at present in Wisconsin physicians attend women in labor in only 40 per cent. of cases, midwives, usually poorly trained, in 40 per cent. of cases, and no trained persons in 20 per cent. of cases. With the establishment of more hospitals and the use of automobiles practically all women might be given opportunity to bear children amid good surroundings and under skilled care, with untold good to the public. Rural nurses in connection with the rural hospitals and visiting nurses in connection with the city hospitals add greatly to their effectiveness.

Besides the need of more effective organization and cooperation there is a need of a reorganization in medical economics. The public should pay for the public services which physicians perform. The evil of extracting a large amount of service for little or nothing is especially marked in the large cities where young physicians are encouraged to do a large amount of dispensary work for "experience." The Robin Hood method of subsequently making the rich pay fees sufficient to cover the services rendered the poor is economically wrong. Public service should be paid for by the public to the medical as well as to the legal profession.

The expenses connected with the early years after graduation as well as the cost in time and money of the long training now demanded of medical students makes it imperative that we should seek to lessen the cost to the student in every way compatible with efficient training. Otherwise we shall limit the profession too much to a restricted class of the well-to-do. By making the relative proportion of the cost of the investment represented by a medical education unduly high to the student we shall encourage him subsequently to become commercialized, to forget that the public and teachers are stockholders in the investment and to make his chief aim in practise the greatest possible financial re-

turn to himself. With the profession confined to a few high-priced practitioners there will be danger of increased quackery for the mass of the people.

If we try to reduce expense by educating large numbers in relatively few medical centers, as seems to be advocated by those in charge of the investigations of medical education for the Carnegie Institutions, I believe that effective results will not be obtained because intimate association between teacher and pupil is necessary for effective training in a complex field like medicine and this becomes difficult or impossible when students are thought of in large masses rather than as individuals. Our schools with the largest endowments and best facilities are thus coming to limit the number of students received in each class. The tendency to encourage students to get the premedical work in academic colleges and the growing number of institutions giving the first half of the medical course show us ways of keeping the number of students taking the preliminary scientific training for clinical medicine restricted to relatively small groups the members of which can receive considerable individual attention. There are two chief difficulties at present connected with this part of the work. First, work in the preliminary sciences at the larger colleges and universities is given to such large classes and sections that individual instruction is hampered unless special sections with special instructors are provided for the premedical students. Second, the premedical work in the sciences is practically always given and the work in the fundamental medical sciences is to a greater or less extent given by men who have not had a medical education and are not intimately acquainted with medical problems. While the fundamental sciences should be taught from a broad point of view and not be restricted to a special aspect thought by the teacher to be all that is necessary for medicine, the training in the basal sciences should be such as to fit the student as simply and directly as possible to view medical problems from the point of view of physics, chemistry and biology and the more specialized sciences. That medicine can be thus viewed from these various points of view will be best appreciated by the student if he is thrown with teachers capable of doing so. Those who administer preclinical courses should keep this fact in mind. If it is kept in mind there is no reason why there should not be gradually established in the country a considerable number of effective preclinical courses where the student can get an effective training for clinical work. Compared with ordinary college courses such courses will be expensive but viewed from the standpoint of their value to society they should be of great value.

The clinical part of medical training presents a more difficult problem. At present the tendency is to devote about one third of the second year and all of the third and fourth years of the four-year medical course, and an interne year to clinical training. The premedical and preclinical medical work takes up the major part of our ordinary four-year academic college course. In addition we require three further years of clinical study, as much time as is required of a college graduate for a Ph.D. degree. The graduate student has opportunities for teaching fellowships sufficient to cover at least the cost of living. The medical student is required to pay large tuition fees in addition to his living expenses except during the interne year when he is relieved of the tuition fee and gets room and board for his services

to the hospital. Students are encouraged to believe that they can get adequate clinical training only in large cities and that the most valuable interneships are in the larger hospitals in these cities. Clinical teaching thus becomes to a large extent mass instruction. Intimate relations between individual students and individual teachers become difficult even during the interne year.

The old apprenticeship system in medical education had some marked advantages which present system of mass instruction lacks. Is it not possible to restore some of the advantages of the old apprenticeship system without loss of modern scientific training? Can we not utilize a large number of clinical centers for clinical teaching and a large number of progressive men as teachers instead of restricting clinical teaching to a few men connected with large hospitals adjacent to medical schools in large cities?

I believe this can be brought about by encouraging a greater number of practising physicians to qualify for the term doctor in its original sense of teacher. Why should not our medical students after two years of premedical college work and two or three years in the medical school be qualified to reside in hospitals, for the most part small hospitals, where they could earn board and room by helpful work about the place and at the same time study under the immediate supervision of members of the hospital staff. Such hospitals should provide diagnostic centers along the lines outlined above. If a few students thus acted as clinical clerks in a series of hospitals during the course of two or three years following the present second or third year in the medical school they could get a broad experience in direct contact with medicine as it is best practised at the present time. Variations in the types of hospitals would secure training in the varied lines of medicine. Each student would come in intimate contact with a considerable number of active progressive men whom he would stimulate and some of whom would in turn inspire. Only hospitals of a certain grade would be recognized for this service and this in turn would serve to stimulate hospital development. The immediate clinical facilities of the medical school could be utilized for supplementing and strengthening the extra-mural hospital service and the clinical staff would have supervision of the clinical teaching in the hospitals and give the final examinations. The expenses of the medical course would be reduced and the public would profit from a more direct training of its practitioners. Furthermore, this system would help to overcome one of the greatest dangers of our present system of education, the destruction of originality through too many years of subordination of personality to mass domination by teachers. It would tend to produce independence in the students.

Such a plan may not, of course, be best for all schools but it may for some. As an association let us maintain the scientific ideal in medicine but let us not carry standardization too far. Let us encourage different methods of reaching the results at which we all should aim, the establishment in our students of habits of independent accurate observation, of judgment based on knowledge of fundamentals and of skilled execution based on practical experience, and then let us study the results as scientifically as possible and base our changes in methods so far as we can on observed facts.

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THE FOREST SERVICE

The annual report of the forester of the Department of Agriculture made public on